（学位第３号様式）

学 位 論 文 要 旨

氏　名	DOSSOU HOUNSA DEGNON SERGE
題　目	Nutritional evaluation of fermented rapeseed meal for marine cultured species （海産魚における発酵菜種粕ミールの利用性に関する栄養学的研究）

The present study was conducted to investigate the dietary ability of microbial fermented rapeseed meal for Red sea bream (*Pagrus major*) and Olive flounder (*Paralichthys olivaceus*).

In the first part of the study, solid state fermentation of rapeseed meal (RM) with *Saccharomyces cerevisiae* (RM-Yeast) and *Aspergillus oryzae* (RM-Koji) was used to change the characteristics of the meal. The fermentation process increased protein content by 17% and reduced antinutrients (ANFs) in fermented meals. In addition, small-size peptides (< 20kD) were increased in RM-Koji. Consequently, a second and third trials were conducted to evaluate the effects of fishmeal replacement by RM-Yeast and RM-Koji on red sea bream performances. In the second trial, fish were fed five diets were RM-Yeast substituted fishmeal at 0, 18.75, 37.5, 56.25 and 75%. Only groups fed diet with 75% substitution recorded significantly lower ($P < 0.05$) growth, feed utilization and unfavorable blood parameters. Lysozyme and peroxidase activities in fish, and reaction to low salinity water were not significantly affected ($P > 0.05$) by RM-Yeast, but 18.75 and 37.5% substitution levels exerted better oxidative status. We concluded thus, that 56.25% of fishmeal protein could be substituted by RM-Yeast without negative effects on fish growth and general health condition. In the third trial, a blend of RM-Koji replaced 0, 25, 50, 75 and 100% of fishmeal in diet for red sea bream. At the end, growth performances were significantly increased ($P < 0.05$) in 25% replacement diet, while growth, feed utilization, protease and protein digestibility were not affected ($P > 0.05$) by up to 50% replacement of fishmeal compared to control. In addition, lysozyme, bactericidal and peroxidase activities were increased in groups fed 25% - 50% replacement levels, together with improved oxidative condition.

A fourth trial was conducted to compare the effects of simple RM and RM-Koji as fishmeal substitution in diet for red sea bream. 50% fishmeal was replaced by either RM or RM-Koji. Groups fed fishmeal and RM-Koji based diets exerted significantly higher growth, hemoglobin and improved triglyceride levels than those fed simple RM ($P < 0.05$). Also, bactericidal, lysozyme, respiratory burst, and peroxidase activities were increased in RM-Koji fed groups over simple RM fed groups. Surprisingly, oxidative status of fish, measured through malondialdehyde concentration and reactive oxygen metabolites, were significantly improved in test groups over control. In the last trial, nutrients digestibility (ADC) for fishmeal, RM, RM-Yeast and RM-Koji were determined for olive flounder using test diets composed of 70% reference diet and 30% of each of the test ingredients following the indicator method with 0.5% chromic oxide (Cr_2O_3) as inert marker. ADC for crude protein of RM-Yeast and RM-Koji were significantly higher ($P < 0.05$) than that for RM. In addition, protease, lipase and amylase activities in juveniles' olive flounders fed RM were lower, while RM-Koji recorded the highest activity, followed by RM-Yeast and FM respectively.

The present study demonstrated that RM-Yeast and RM-Koji could be included by up to 50% in diet for red sea bream without compromising growth and health condition of fish. At the same level, RM-Koji induces better growth and immune responses than simple RM in red sea bream juveniles. In addition, feedings olive flounder with fermented RM leads to better nutrients digestion together with intestinal enzymes improvements.